F·A·A·M facility for airborne atmospheric measurements

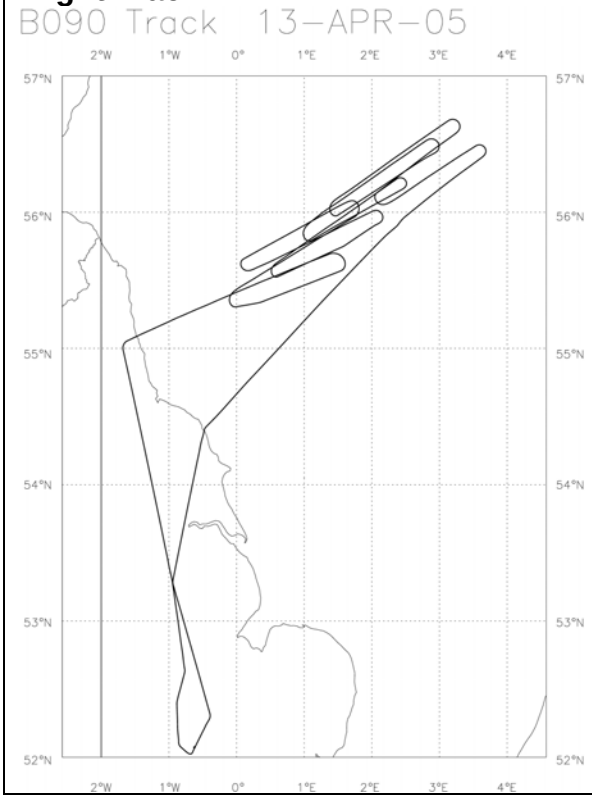
FLIGHT FOLDER

Flight No.:	B090
Date:	13 Apr 2005
Take Off	10:39:37
Landing:	15:47:32
Flight Time	5h07m55

Campaign: CIRRUS
Trials Instructions:
Operating Area: North Sea

POB	Position	Name	Institute
1	Captain	Charlie Whitaker	BAes
2	Co-pilot	Alan Foster	Directflight
3	Aircraft Scientist	Phil Brown	Met Office
4	Flight Manager	John Reid	FAAM
5	Cloud Physics	Paul James	FAAM
6	Core Chemistry	Ruth Purvis	FAAM
7	PTRMS	Anne Hulse	UEA
8	ADA/CPI	Keith Bower	University of Manchester
9	AMS	Paul Williams	University of Manchester
10	Noxy	Dave Stewart	UEA
11	WAS / PAN	Jim Hopkins	York University
12	Air Sample Bags	Daniella Famulari	CEH Edinburgh
13	Mission Scientist Training	Eiko Nemitz	CEH Edinburgh
14	CCM - training	Jackie Mulholland	Directflight
15	CCM2 - training	Jamie Trembath	FAAM
16	CCM	Gaynor Ottaway	Directflight
17			
18			
19			
20			

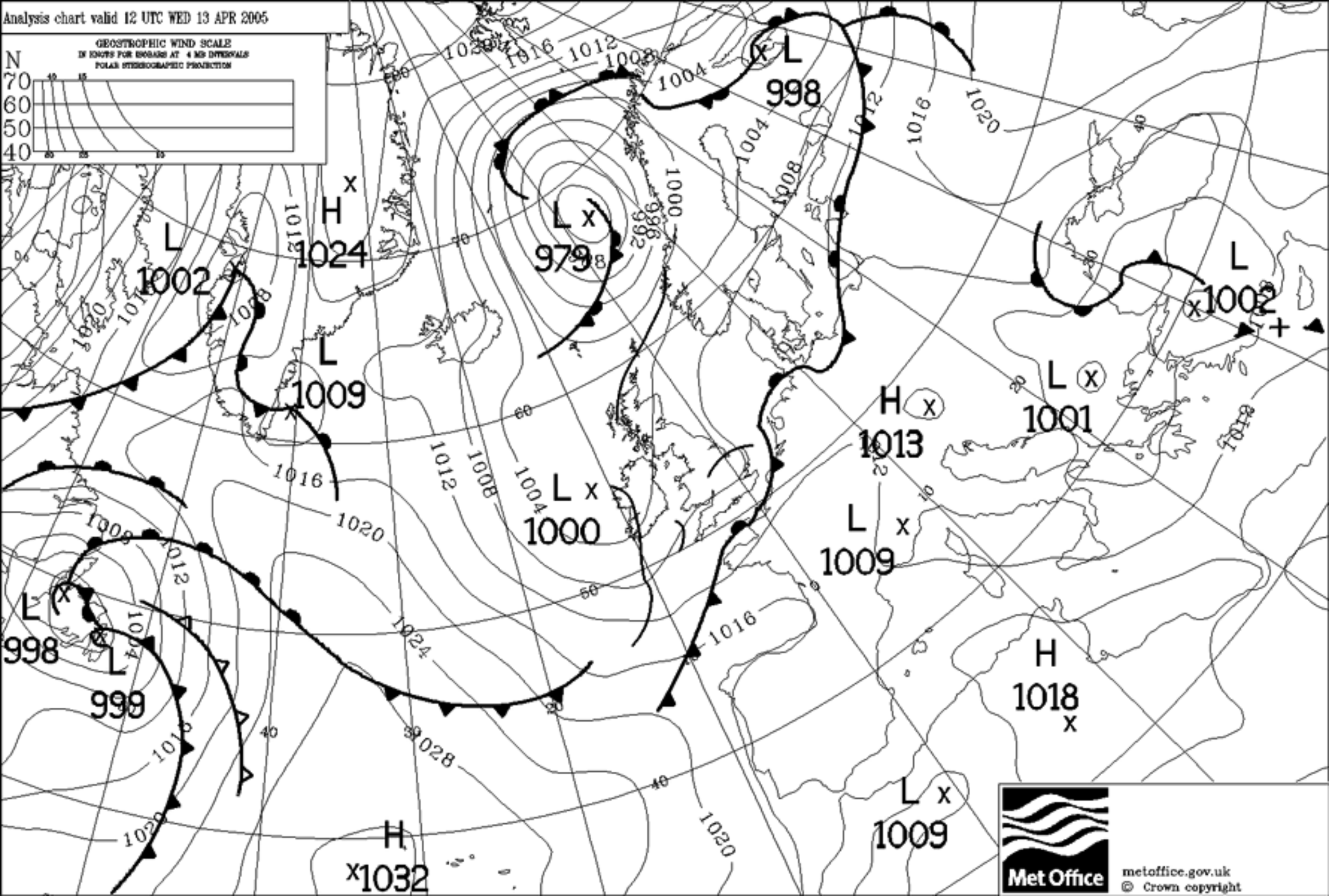
Flight Track:



FLIGHT SUMMARY

Flight No B090
Date: 13th April 2005
Project: UTLS - Cirrus
Location: North Sea

Start Time	End Time	Event	Height (s)	Hdg	Comments
100259		GPS start posn	0.49 kft	128	52'04.36N 000'37.48W
102433		INU to NAV	0.49 kft	128	
102607		Engine Start	0.49 kft	128	
102937		Power C/O	0.49 kft	128	
103206		Taxy start	0.50 kft	128	
103937		Take off			Cranfield
104100		ASPs opened			
110206		Video	15.0 kft	339	Recording FFC & DFC
112729	114223	Profile 1	20.5 - 31.0 kft	068	
113910		Profile 1			Ascend @ 500'/min
114544	115541	Run 1	31.0 kft	249	Con trails
115921	120924	Run 2	30.0 kft	060	
121236	122241	Run 3	29.0 kft	245	Con trails
122730	123733	Run 4	27.5 kft	070	
124027	125029	Run 5	26.0 kft	241	No con trails
124455		Run 5	26.0 kft	245	heading change
125508	130507	Run 6	24.5 kft	058	
130951	132010	Profile 2	24.9 - 32.0 kft	242	
131652		Profile 2	31.0 kft		Con trails
132324	133325	Run 7	31.1 - 31.0 kft	054	Con trails
133606	134603	Run 8	30.0 kft	243	Con trails
134947	140000	Run 9	29.0 kft	058	
140200		Video			Change tapes
140241	141243	Run 10	27.0 kft	236	
141551	142340	Run 11	25.0 kft	061	Short run - ATC
142637	143700	Run 12	23.5 kft	236	
153350		ASPs closed			
153420		Video	7.9 kft	163	Stop recording
154732		Land			Cranfield
155257		GPS stop posn	0.58 kft	309	52'04.36N 000'37.50W


Analysis chart valid 12 UTC WED 13 APR 2005
GEOSTROPHIC WIND SCALE
IN KNOTS FOR 850MB AT 4 MB INTERVALS
POLAR STEREOGRAPHIC PROJECTION
N
70
60
50
40
40
15
40
25
15
L
998
L
979
H
1024
L
1002
L
1009
L
1000
H
1013
L
1001
L
1009
H
1018
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998
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999
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1032
L
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1004
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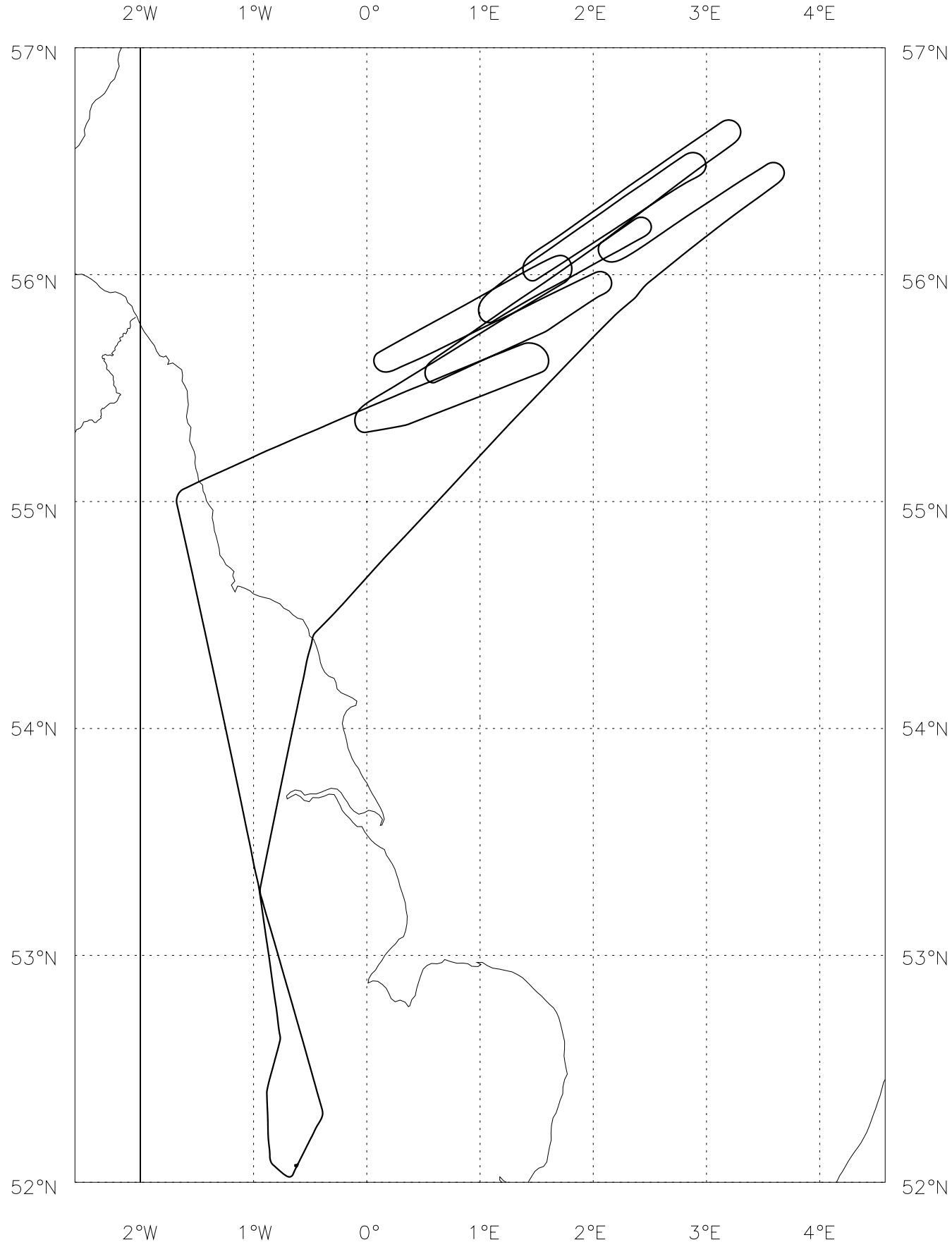
B090 Track 13-APR-05



Sortie Title UTLS Cirrus- Cirrus cloud microphysics and chemistry Option 1

Scientific Aims:

1. To measure the total number of Condensation Nuclei (CN), CCN, IN and the size distribution of optically active particles in clean and polluted air in the UTLS region over the UK. Assessment of their spatial distribution and their likely source based on tracer measurements and air mass history.
2. To quantify the extent to which air mass history, and gas and particle loading can affect the microphysical properties of cirrus clouds in the UTLS region, in particular, the size distribution, phase and morphology of cloud particles.
3. To obtain estimates of HNO_3 loss to cirrus clouds and the subsequent effect on the aerosol population after the cloud has evaporated using case studies involving one or more wave clouds.
4. To make observations of the number, size distribution, phase and morphology of droplets and crystals in cirrus cloud and the number and size distribution of interstitial particles and correlate these with measurements of tracers that identify anthropogenic influence. Hence building on objective 3 to investigate the influence of cirrus on the distribution of aerosol and gases in the UTLS region as cloud and precipitation evaporate.
5. To make an assessment of the chemical composition of the particulate in the UTLS region as a function of their size, their spatial variability and the effect different sources have on their composition.
6. To use measurements of the masses of key components as a function of size of cirrus particle dry residues and interstitial particles to determine if there are distinct chemical differences between activated and unactivated particles.
7. To establish the partitioning of oxidised nitrogen between the gas and aerosol phases as a function of air mass history and source region

Weather conditions

Cirrus cloud preferably associated with the polar front jet preferably over the UK.

Key Measurements

All instruments to be operated continuously.

1) Cloud Physics

- FFSSP, 2DC, 2DP, PCASP, SID-1 (and SID-2). Normal monitoring to ensure correct operation. Operator should note particular features of interest eg. high concentrations, appearance of pristine ice crystal habits.
- ADA/CPI – as above
- CCN - alleviator should be filled whilst in clear air either below, between or upwind of the cloud layer(s) of interest. 1 sample per run, if possible.
- Ice Nucleus counter (INC) normally operated in clear air and under fixed conditions of temperature and supersaturation so as to maintain it in a stable condition. Allow additional time between runs for the operator to adjust it to a different set of conditions.
- J-W LWC and Nevzorov LWC/TWC. Where run is only partially in cloud and starts in clear, these should be zeroed/calibrated and logged by Flight Manager.

– TWC – initial profile should avoid cloud, if possible, to achieve good calibration.

2) FWVS – Switch off the lamp when frost point rises above -15C. Calibration should be performed following altitude changes.

3) WAS - 2 bottle samples per 10min flight leg unless otherwise notified by the Mission Scientist.

4) AMS - to be operated on Rosemount inlet. The inlet should be kept closed to avoid contamination whilst the GPU is operating prior to takeoff. It may be opened once the GPU has been removed. Similarly, intake should be closed before GPU is started post-flight.

5) Video – the default recording setup should be forward and rear. Flight manager or Flight Scientists should monitor rearward video and inform Mission Scientist of any occurrences of contrail formation (or cessation) and these should be noted in log sheets.

Sortie Brief UTLS CIRRUS - Cirrus cloud microphysics and chemistry Option 1

Flight Number B090
Date 13 April 2005

Sortie Aims: To make measurements of the microphysics of cirrus clouds and their interaction with local aerosol and oxides of nitrogen. To investigate the effects of precipitation from the cloud on the vertical distribution of aerosol and oxidized nitrogen

Sortie Location: In layers of cirrus cloud likely to be anthropogenically influenced.

Sortie Summary: The aircraft will initially make a vertical profile from well below cloud base to above the top of the cirrus. It will then make a series of straight and level runs of 10 minutes duration at several altitudes below, in and, when possible, above the cloud top. The straight and level runs above and below cloud will concentrate on determining the gaseous composition and aerosol physical and chemical properties of the air. Measurements of the vertical wind velocity will be made here. A straight and level run will be made very close to cloud base to determine whether supercooled water droplets or ice crystals are being activated.. Runs progressively deeper into the cloud will then be flown. SLRs will also be made in the fall streaks of the cirrus to characterise the precipitation in this region and to investigate the influence of the evaporation of the precipitation on the aerosol properties and trace gases in the region of the fall streaks.

Sortie Detail

a. T+0 Take off and climb to FL200 for transit to operating area.
b. T+40 Perform vertical profile through cirrus from below cloud base to aircraft ceiling, or to above cirrus top whichever is the lower.
c. T+60 Descend to below base of cirrus generating cells and perform straight and level run parallel to the mean wind direction 300 feet below cloud base for 10 minutes.
d. T+75 Turn through 180 degrees. Ascend to cloud base and perform straight and level run for 10 minutes just in cloud at the base of the generating cells just in cloud. Deviations from the straight run may be made in order to penetrate generating cells provided such penetrations can be achieved with wings level.
e. T+90 Turn through 180 degrees ascend to middle of cloud and perform straight and level run for 10 minutes
f. T+105 Turn through 180 degrees and if possible ascend to above cloud top and perform straight and level run duration 10 minutes above cloud top
g. T+120 Descend to below cirrus base and make level runs through fall streaks adjusting flight path to pass through fall streaks as required.
h. T+135 Descend to lowest altitude reached by fall streaks and make and level runs through the residue.
i. Repeat items b to h as time permits
j. T+260 return transit
k. T+300 Land

Mission Scientist Debrief: **Flight B090**

UTLS/CIRRUS **13/4/2005**

After take-off, climb-out to FL150 for NOxy calibration whilst on transit to approx the Newcastle area. Initially, copious amounts of contrail were visible overhead, comprising most of the visible cirrus. Further to the N, presumably in an area of reduced air traffic, the cirrus was still extensive but with less obvious contrail influence. Initial profile ascent was performed on a heading of about 070deg, approximately along the mean wind direction.

At the maximum altitude of the initial profile, FL310, the majority of the cirrus appeared to be below the aircraft but with just occasional regions above. This was confirmed on the initial 10 min flight leg at FL310. Since no significant generating cell structures were visible, it was decided to conduct the sortie as a simple descending pattern of flight legs, at the following further altitudes, FL300, 290, 275, 260 and 245, drifting with the mean wind and so moving further into the N.Sea. The latter altitude was selected since it was estimated to approximately the base of fallstreak activity as observed during the initial profile. During these flight legs, the cirrus was observed to be inhomogeneous in the horizontal, with variations of crystal concentration and habit. Occasional pulses of well-defined bullet-rosettes were observed. The CPI also reported plates and columns at the higher altitudes. At FL245, the cirrus fallout was observed to be reaching just below the flight level.

Following the first pattern of legs, a second profile ascent was completed, halting at FL320 since this was observed to be above the cirrus tops, and just into the stratosphere. The highest cirrus tops were, therefore assumed to be just at the tropopause. Another descending pattern of flight legs was commenced, starting at FL310 which was just brushing the highest cloud tops. The following flight levels were at FL300, 290, 270, 250 and 235. The 2000ft separation was introduced since it appeared that only 5 legs might be possible in the remaining mission time. However, it turned out that a 6^{th} was possible. During this second pattern, it appeared that the cirrus might have become thinner although it was still patchy in the horizontal. On the leg at FL290, the aircraft contrail from the previous leg was clearly visible above and to the right. Significantly higher values were observed on the Nevzorov TWC at lower levels in the cirrus layer, as expected.

On completion of the last flight leg, the aircraft descended to FL200 initially for the return transit. The air remained moist down to this level and approaching the coast, cirrus was re-enetered. This became quite thick to the point where the surface below became obscured. This confirmed the expected evolution from the mesoscale model forecast earlier in the day. This showed a thin layer of cirrus extending into the N.Sea after about 11Z, becoming thicker with medium level cloud over the coast by 15Z. A further NOxy calibration at FL150 was completed during the return.

Approaching Cranfield, Cumulus with tops to ~FL120 was present, with occasional showers showing on the weather radar.

Phil Brown.

Phil Brown.

Aircraft Scientist's Log

Flight No B.090 Date 13/4/05 Page 1 of 5

GMT	Run / Profile	Height	Hdg	GPS Position	Remarks (clouds, weather, visibility, winds, sea state etc.)
					Initial fuel 4490 1210 4450
					+ belly tank.
1039					T/O Coanfield QNH 1008
/					5/8 Cu 2800ft 1013.
/					Tops ~ 6000ft. Thin Sc above
/		GE			dew point cal. in HORACE looks
/		poor.	Td	exceeds T by several degrees
/		during	climbs	through cloud.
1052		PCASP	failure	again.
/		extensive	contrail	activity above in
/		this	patch.	52.7 N 0.8 W
1102		15000		53.4 N 1.0 W level on transit T -18.3 Td -30.5
1111		"		Cirrus has a lot of contrail
/				involvement. and looks quite
/				thin/high to the N & E. Likely operating area at this time
/				Can see some signs of gen cell
/		17000		activity to the W. aerosol layer.
111630				PCASP reports OK again
		20000		QNH 2d particles —
/				probable T=Td approx.
45 min 112434		"	070	
112707		20000		PCASP gone again.
112729		"	070	55.1 0.9W Profile 1
112949				Td ~ 3deg > T
1132		25300		2d particles loose
			Can see	fallstreak activity.

26500

31
30
29
275
26
245

Aircraft Scientist's Log

Flight No B 090 Date 13/4/05 Page 2 of 5

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GMT	Run / Profile	Height	Hdg	GPS Position	Remarks (clouds, weather, visibility, winds, sea state etc.)
		29500			Poss highest level of Ci
114011		30200		Some	wisps above FL300 ahead.
—				Still	v. moist.
114223		31000		55.6 1.3E	End P1
1145	R1	"	250	55.5 1.4	Start R1 contrail behind
—				Above	Ci top most of this leg.
115541	R1	"	257	55.3 0.1E	End. descend straight ahead
115921	R2	30000	061	55.4 0.0	Start R2 GPI reports just onto Oates at start.
				Looks	like we will skim cloud top
90 min 120424		"		Still	just in tops.
—				PCASP	still failed.
—				Vernal	signals on NavTWC
120924	R2	"	062	55.9 1.6E	End R2.
	R3	29000	242		Start R3
				2dC	shows variability of con
				but	basically continuous.
1222	R3	"	"	55.7 0.3E	End R3
1227	R4	27500	070	55.5 0.3E	Start R4
1225		"		pulse	of bill-rosettes coincident
				with	NTWC pulse?
—		Wind	~ 23	ms⁻¹ / 240 deg.	Moves Hdgs
—		of Ci	top ~	75 km/hr⁻¹	:. runs
—		should	still	accom.	most of Ci Hdgs
1228		Poss	data	dropout	spike - all params?
—					

Aircraft Scientist's Log

Flight No **B**...090 Date ...13/4/05 Page 3 of 5

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GMT	Run / Profile	Height	Hdg	GPS Position	Remarks (clouds, weather, visibility, winds, sea state etc.)
123730	R4	27500	057	55.9 1.9E	End R4
2hr. 124027	R5	26000	240	55.8 2.0E	Start R5
1243				TWC	looks well-behaved.
1245		"		Cloudy	approaching base of
125029	"	"	245		End R5
					1248 data dropouts again
1255	R6	24500	060	55.6 0.6E	Start R6
		TWC	always	have a little	spike up at
		start	of each	new level.	Is this a pass.
—		flow	problem.		
1303		just	entering	cloud	region which
		precipitates		a bit	below this level.
130507	R6	24500	057	56.1 2.1E	R6 End turn recip. for
—					profile.
130957	P2	24500	243	56.1 2.3E	Start P2
—		29500	↗	Can	see patchiness of Ci regions
—				ahead.	Nocturious reason to
				change	op. area
		30500			top of profile just into detraph, high O3
131900		32000			End P2 & turn recip.
1323	R7	31000	054	55.9 1.1E	Start R7.
—					core chem said high CO during high O3 peak.
—			Just	bucked	cloud tops along this run
133327	R7	"	058		End R7

Aircraft Scientist's Log

Flight No B.090 Date ..... Page 4 of 5

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GMT	Run / Profile	Height	Hdg	GPS Position	Remarks (clouds, weather, visibility, winds, sea state etc.)
133604	R8	30000	243	56.4 2.8E	Start & well into main dark top
134603	R8				End R8 descend for 290
1349	R9	29000	57	56.0 1.5	Start R9 over contrail v. visible on RHS as we fly reciprocal.
					wind still 22/238
135950	R9	11		56.6 3.1	End R9 ran seems to have been much out of cloud but some NTWC towards end.
140244	R10	27000	236	56.5 3.1	Start 26/237 wind.
		Generally, Ci seems to have got thinner & more tenuous which has dulled steadily with time.			esp at SW end of pattern
1412	R10	11	236	56.1 2.0E	End R10 left turn.
141550	R11	25000	061	56.0 2.3E	Start R11 Still some quite dense patches appearing on NTWC.
142343	R11	11		56.4 3.6	End 11 end early to avoid Copenhagen.
142637	R12	23500	236	56.3 3.5	Creates strong impression of being close to lowest level of Ci pattern.
					NTWC showing fluctuations along run.
143400	R12	11		55.9 2.4E	End 12. descend FL200 initially.
		20000		Profile	stayed most down to this level.
1457		11			Ci definitely seems thinner as come back SW.
1455		11			But into thicker patch at this level.
1457		11			becoming quite dense now.

Aircraft Scientist's Log

Flight No B090 Date 13/4/05 Page 5 of 5

GMT	Run / Profile	Height	Hdg	GPS Position	Remarks (clouds, weather, visibility, winds, sea state etc.)
1507		15000	228	52-4N 0 3W	Level for NOxy cals.
		Td finally fell below Tat ~ 555 mb			
—		Confirm GE front panel ~ 3.5° lower			
—		than Honeywell display.			
1511		Patchy As ~ 12000 ft. with some occ			
—		Cu reaching to that level.			
—		8/8 Sc below.			
1527		15000			Noxy cal complete.
—		4/8 Cu with tops to ~ 12000. -14°C			
—		would make pass ICEPIC day later on!			
—		Just NTWC looked OK during passage			
1534		through Cu tops.			
		Occ precip showing on lwr radar.			
—		Cu base ~ 3000 ft.			
1550					On clear.
					5h10 ✓
—					1800 kg fuel remains.

FLIGHT NUMBER	B090	DATE:	13/4/04	OPERATOR:	RMP
PROJECT:	CIRRUS				

CORE CHEMISTRY PRE FLIGHT LOG

PRE POWER UP	
All sample lines are connected to the rack	OK
All cylinders pressures are OK	OK
Ozone Span = 504, Offset = 50	OK

GAS PRESSURES	N_2 (bar)	CO_2 / Argon (bar)	CO standard (bar)
PRE FLIGHT	40	145	145
POST FLIGHT	22	142	145

POST POWER UP - GROUND				
Ozone Sample Flow 1 (LPM)	**Ozone Sample Flow 2 (LPM)**	**NO_x Sample Flow (LPM)**	**NO_x Ozonator Flow (LPM)**	**SO_2 Sample Flow (LPM)**
0.4	**0.45**	**0.903**	**0.068**	**0.478**
CO Time check against HORACE	**CO Lamp Flow (ml/min)**	**Pressure Monochromator (bar)**	**Pressure Cell (Torr)**	
OK	**34.06**	**1.13**	**7.17**	

ZEROS							Average
Ozone (ppbV)	**-1**	**-2**	**0**	**1**	**0**	**1**	
NO (ppbV)	**2.51**	**5.52**	**2.60**	**2.67**	**2.71**	**2.67**	
NO_2 (ppbV)	**3.01**	**2.96**	**2.85**	**2.79**	**2.73**	**2.74**	
NO_X (ppbV)	**5.52**	**5.48**	**5.85**	**5.46**	**5.44**	**5.41**	
SO_2 (ppbV)	**-0.03**	**0.08**	**0.11**	**-0.10**	**-0.30**	**-0.43**	

PRE FLIGHT COMMENTS
NOx taking a long time to zero – tubing on trap dirty

FLIGHT NUMBER	B090	DATE:	13/4/04	OPERATOR:	RMP
PROJECT:	CIRRUS				

CORE CHEMISTRY CALIBRATION AND FLOW LOG

PREVIOUS CO CAL	Date and Flight Level	Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)
	HANGAR	93.15	83.38	7766.28

Time	Flight Level	CO				
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)
10:15:29	ON PAN	84.10	85.17	7162.39	50.00	7.15
		Flows (LPM unless stated)				
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO_2 Sample
		33.91	0.4	0.45	1.105	0.066	0.476
Time	Flight Level	CO				
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)
10:57:43	FL150	81.32	85.71	6969.55	50.00	7.14
		Flows (LPM unless stated)				
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO_2 Sample
		33.88	0.7	0.8	1.057	0.064	0.298
Time	Flight Level	CO				
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)
11:00:00	FL150	81.29	86.00	699.50	50.0	7.14
		Flows (LPM unless stated)				
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO_2 Sample
		33.85	0.7	0.8	1.057	0.064	0.297
Time	Flight Level	CO				
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)
11:25:58	FL200	82.01	84.52	6931.81	50.1	7.14
		Flows (LPM unless stated)				
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO_2 Sample
		33.87	0.7	0.8	1.033	0.065	0.236
Time	Flight Level	CO				
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)
12:00:43	FL300	81.15	86.23	6997.88	50.0	6.51
		Flows (LPM unless stated)				
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO_2 Sample
		33.87	0.7	0.8	0.974	0.065	0.116

FLIGHT NUMBER	B090	DATE:	13/4/04	OPERATOR:	RMP
PROJECT:	CIRRUS				

CORE CHEMISTRY CALIBRATION AND FLOW LOG

Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
12:14:48	FL290	81.64	85.97	7018.95	50.0	6.79	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.84	0.7	0.8	0.981	0.066	0.131
Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
12:29:08	FL275	82.05	84.56	6938.21	50	7.02	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.87	0.7	0.8	1.007	0.065	0.151
Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
12:42:32	FL260	82.59	84.25	6958.28	50.0	7.14	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.84	0.7	0.8	1.009	0.065	0.165
Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
13:24:47	FL310	83.61	85.29	7131.10	50.0	6.54	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.88	0.7	0.8	0.962	0.066	0.105
Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
13:51:43	FL290	84.21	83.75	7053.33	50.0	6.82	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.85	0.7	0.8	0.986	0.05	0.131

FLIGHT NUMBER	B090	DATE:	13/4/04	OPERATOR:	RMP
PROJECT:	CIRRUS				

CORE CHEMISTRY FLIGHT LOG

Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
14:05:32	FL270	84.62	82.38	6970.62	50.0	7.10	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.91	0.7	0.8	1.005	0.065	0.155
Time	Flight Level	CO					
		Sensitivity (Hz/ppbV)	Bkgrd (ppbV)	Bkgd Cnt R (Hz)	Lamp Temp (°C)	Cell Press (Torr)	
14:18:50	FL250	84.90	82.30	6987.01	50.0	7.12	
		Flows (LPM unless stated)					
		CO Lamp Gas (ml/min)	Ozone Sample 1	Ozone Sample 2	NO_X Sample	NO_X Ozonator	SO2 Sample
		33.77	0.7	0.8	1.001	0.065	0.178

GENERAL COMMENTS

Power changeover went OK – lamp only cooled to 49.5 degrees

ASP opened 10:41:00

Layer of pollution between FL260 FL280

11:48 positive correlation between O3 and CO

Run 7 So2 log 13:232:24

0.90 0.63 0.58 0.94 1.31 1.1 0.8 1.36 1.11 0.16 1.46 1.03 0.81 0.57 0.99 1.53 0.69 0.87 1.28 0.99 1.46 0.76 0.96 0.99

Terminated 13:27:03

CLOUD PHYSICS LOG

Flight No. B090 **Date: 13/4/05** **Operator: papj**

G.M.T.	PCASP		FSSP	SID1	2D2-C			2D2-P			Remarks
DRS Time	Conc/cc	Mean R	Block Transfer	Particle Count	Conc/L	Max Size	Habit	Conc/m3	Max Size	Habit	
											Pcasp failed and is back up and working Pcasp failed and is back up and working at 1214
112729											Start p1 pcasp failed
											210
											220
											230
											240
					10	400	8				250
					20	300	8				260
					20	400	10				270
					50	200	11				280
					10	100	11				290
					10	200	11				300
114223											310 end p1
114544											Start run 1.1 @310
1147	Pcasp no ref voltage										
1149											
1151					10	100	11				
1153											
115541											End run 1
115921											Start run 2 @300
1201					5	50	11				
1203					10	50	11				
1205					10	50	11				
120924											End run 2
121236											Start run 3 @ 290
1214					10	100	11				
1216					20	150	11				
1218					60	200	11				
1220					30	175	11				
122241											End run 3

CLOUD PHYSICS LOG

Flight No. B090 **Date: 13/4/05** **Operator: papj** **Page 2 of 4**

G.M.T.	PCASP		FSSP	SID1	2D2-C			2D2-P			Remarks
DRS Time	Conc/cc	Mean R	Block Transfer	Particle Count	Conc/L	Max Size	Habit	Conc/m3	Max Size	Habit	
122730											Start run 4 @ 275
1229					10	50	11				
1231											
1233					10	50	11				
1235					10	50	11				
1237					40	175	11				
123733											End run 4
124027											Start run 5 @ 260
1242					20	100	11				
1244											
1246					10	150	11				
1248					40	150	11				
1250					20	200	10				
125029											End run 5
12:55:08			24	10	20	200	10				Start run 6 @ 245
12:57			24	75	10	200	10				
12:59			24	50	15	325	10				
13:01			24	10	35	100	11				
13:03			24	10	30	200	10				
13:05:07			24	10	20	200	10				End of run 6
13:09:51			24	10	10	50	11				Start P2 @ 245
13:10:42			24	10	34	50	11				255
13:11:44			24	75	10	50	11				265
13:12:44			24	20	15	175	11				275
13:13:44			24	20	20	200	10				285
13:14:44			25	1	15	50	11				295
13:16:19			25	100	0	0	0				305
13:17:52			25	1	1.5	200	10				315
13:19:00			25	1	0	0	0				P 2 end 320
13:23:24			25	1	0	0	0				Start run 7 @ 310
13:25			25	100	0	0	0				
13:27			25	1	0	0	0				
13:29			25	1	0	0	0				

CLOUD PHYSICS LOG

Flight No. B090 **Date: 13/4/05** **Operator: papj** **Page 3 of 4**

G.M.T.	PCASP		FSSP	SID1	2D2-C			2D2-P			Remarks
DRS Time	Conc/cc	Mean R	Block Transfer	Particle Count	Conc/L	Max Size	Habit	Conc/m3	Max Size	Habit	
13:31			26	1	0	0	0				
13:33			26	1	0	0	0				
13:33:25			26	1	0	0	0				End of run 7 @ 310
13:36:06			26	10	5	200	10				Start run 8 @ 300
13:38			26	10	2.5	150	8				
13:40			26	100	20	100	11				
13:42			27	100	0	0	0				
13:44			27	5	9	175	10				
13:46:03			27	1	0	0	0				End of run 8 300
13:49:47			27	1	0	0	0				Start run 9 @ 290
13:51			27	1	1.5	50	11				N.B. PCASP Vref fluct max 0.16
13:53			27	1	0	0	0				So is FSSP Vref on SEADAS
13:55			27	10	2	50	11				
13:57			27	10	10	175	10				
13:59			28	100	1	150	11				
14:00:00			28	100	10	200	10				End of run 9
14:02:38			28	10	20	125	10				Start of run 10 @ 270
14:04			28	100	66	200	10				Flew right though fall streak
14:06			28	75	10	200	10				
14:08			**28**	1	2.5	150	10				
14:10			28	10	15	150	10				
14:12			28	10	20	175	10				
141243											End run 10
141551											Start run 11 @250
1417			29	100	70	200	10				
1419			30	100	30	175	10				
1421			30	100	50	200	10				
1423			30	75	20	200	10				
142340											End run 11
142637											Start run 12 @235
1428			31	1	60	200	10				
1430			31	75	10	100	10				
1432			31	100	50	150	10				

CLOUD PHYSICS LOG

Flight No. B090 **Date: 13/4/05** **Operator: papj** **Page 4 of 4**

G.M.T.	PCASP		FSSP	SID1	2D2-C			2D2-P			Remarks
DRS Time	Conc/cc	Mean R	Block Transfer	Particle Count	Conc/L	Max Size	Habit	Conc/m3	Max Size	Habit	
1434			31	75	20	200	10				
1436			31	50	20	150	10				
143700											End run 12

WAS Sampling Summary

Flight Number:	B090	Campaign Name:	CIRRUS
Date:	13/04/2005	Operator:	J. Hopkins (York)

Bottle Start Fill Time	Bottle End Fill Time	Bottle Number	Comments	Final Pressure (bar)
11:27 to 11:42			Profile 1, FL200 ascending to FL310 above cloud	
11:45:00			Level run above cloud	
11:49:31	11:50:31	25	FL310	2.20
11:52:31	11:53:31	26	FL310	2.20
11:55:00			End of run; descending to FL300 (manifold pressure 2.43)	
11:59:00			Level run at FL300 (manifold pressure 2.43)	
12:02:04	12:03:04	27	FL300	2.28
12:06:30	12:07:30	28	FL300	2.29
12:09:00			End of run; descending to FL290	
12:12:00			Level run at FL290	
12:17:35	12:18:35	29	FL290	2.36
12:20:30	12:21:30	30	FL209	2.37
12:22:00			End of run; descending to FL275	
12:27:00			Level run at FL275	
12:30:30	12:31:30	31	FL275	2.46
12:34:30	12:35:30	32	FL275	2.50
12:37:00			End of run; descending to FL260	
12:40:00			Level run at FL260	
12:44:20	12:45:20	33	FL260	2.54
12:47:30	12:48:30	34	FL260	2.54
12:50:00			End of run; descending to FL245	
12:55:00			Level run at FL245	
13:03:09	13:04:09	35	FL245	
13:05:00			End of run	
13:09 to 13:20			Profile 2- FL245 to FL320	

13:20:00			Descending to FL310	
13:23:00			Level run at FL310	
13:26:10		36	FL310, fast fill for 90 seconds	2.40
13:28:30		37	FL310, fast fill for 90 seconds	2.42
13:31:01		38	FL310, fast fill for 90 seconds	2.41
13:33:00			End of run; descend to FL300	
13:36:00			Level run at FL300	
13:40:00	13:41:00	39	FL300	2.28
13:44:01	13:45:01	40	FL300	2.28
13:46:00			End of run; descend to FL270	
13:49:00			Level run at FL290	
13:53:30	13:54:30	41	FL290	
13:57:29	13:58:29	42	FL290	2.34
14:00:00			End of run; descend to FL270	
14:02:00			Level run at FL270	
14:06:30	14:07:30	43	FL270	
14:10:11	14:11:11	44	FL270	2.50
14:12:00			End of run; descend to FL250	
14:15:00			Level run at FL250	
14:19:59	14:20:59	45	FL250 (NB: possible problem with bottle- didn't appear to open immediately)	
14:23:00	14:24:00	46	FL250 (Run cut short)	2.63
14:23:00			End of run	
14:26:00			Level run at FL235	
14:31:30	14:32:30	47	FL235	

SUMMER 2005.

13/4/05.

CPC flows calibrated.

Voltage = 190

High flow at 4.5 l/min

0700 - Power on
0800 - Power off
0830 - All pumping again
Heater on.

1000 Quad box on, but no filament

10 50 GMT.

Doing EM

Changed EM current from 0.15 to 0.3

KV = 2.425

Gain = 3.40×10^6

Airborn 3.06 $\times 10^6$

10 55, Tuning!

Det inn	22	20
Det outer	12	11
HB	~~-6.46~~ -6.46	-6.51
Foc	13.50	14.50
Qx	206	216

1% bulk.

Accepted.

Done EM again

New KV = 2.450

Gain = 3.65×10^6

Masses 11 16 18 28 30

43 44 46 48 57

1117. Autosave on

10 secs/scale.

28 in.

General All.

Runs now backed up

running.

All seems ok. CPC Flow = 1.00 @ 25 kft.

Flow down to 0.43 now. Crap

Low I, really not seeing anything at all right.

16:11 BST — AMS PC has rebooted — and entered wrong set up mode

— reset PC — failed to boot up

16:40 — last Aerosol bit in AMS data (15:40 BST) — now 16:15

∴ last ½ hour data is lost

From data log entry 14:46 →

Landed 1548 GMT

Inlet closed, still logging

1556 — Filter on Aerosol flow

1612 — Saved files .1826

1655 None Aerosol Nitrate 1827

Try again with correct mass. 1828.

$IE = 1.809e$

$IE/m_z = 7.132e^{-13}$.

$AB_{TOF} = 1.17e^{6}$

$AB_m = 2.31$.

Did Mass Cal in TOF_MS not general.

Screen dumped

Flight Manager's Instrument Status Log

Flight No. **B**090 Date: 13/04/05

Instrument	Fitted	Operated	Instrument	Fitted	Operated
Navigation			**Cloud Physics**		
INU		**Y**	**Probes**		
GPS		**Y**	FFSSP	**Y**	**Y**
Satcom C		**Y**	PCASP	**Y**	**Y**
Satcom H		**Y**	2D-P	**Y**	**Y**
Thermometers			2D-C	**Y**	Y
De-Iced Temp		**Y**	Cloudscope	**Y**	**N**
Non De-Iced		**Y**	SID 1	**Y**	**N**
Heimann		**Y**	SID 2	**Y**	**Y**
Hygrometers			CPI	N	
G. Eastern		**Y**	HVPS	**N**	
J. Williams		**Y**	**Racks:**		
Nevzorov		**Y**	INC	**N**	
TWC		**Y**	CCN / CNC	**Y**	**N**
FWVS		**N**	CVI	**Y**	**N**
Radiometers					
Upper Clear	**Y**	**Y**	**Aerosol**		
" Red	**Y**	**Y**	PSAP	**N**	
" Silicon	**Y**	**Y**	Nephelometer	**N**	
" JO1D	**N**		Filters	**Y**	**Y**
Lower Clear	**Y**	**Y**	AMS	**Y**	**Y**
" Red	**Y**	**Y**			
" Silicon	**Y**	**Y**			
" JO1D	**N**				
Large Radiometers			**Others:**		
TAFTS		**N**	NIR TDLAS	**Y**	**N**
MARSS		**N**	2BT O3	**Y**	**N**
DEIMOS		**N**	VACC	**Y**	**N**
ARIES		**N**	PEROXIDE	**Y**	**N**
SWS		N	Formaldehyde	**Y**	**N**
Chemistry			ADA		**Y**
Ozone	**Y**	**Y**	CPI		**Y**
ECGC	**N**		NOxy		**Y**
NOX	**Y**	**Y**	PTRMS		**Y**
CO	**Y**	**Y**	Bag Sampling		**Y**
ORAC	**Y**	**N**			
PAN	**Y**	**Y**			
PERCA	**Y**	**N**			
WAS	**Y**	**Y**			

Faults / Incidents Log

Flight No. B090
Date: 13/04/05

Instruments

1. Video – DFC and RFC camera titles reversed. Changed camera settings pre-flight
2. Video – RFC display out of focus.
3. CNC serial cable fitted but no HORACE communication
4. PCASP operation intermittent – about 10 minutes useful operation at a time. Eventually unrecoverable.
5. Radalt – reading intermittent zero feet on ascent after take off
6. GE – HORACE calibration constants suspect
7. HORACE – derived data (all?) dropped out briefly to zero then recovered at around 12:27Z and again - for longer - at around 12:45Z
8. Nev LW HORACE trace fixed to zero – cycled power to reset – trace still very flat
9. FM PC completely locked up – rebooted ok
10. AMS – nothing seen on instrument. This could be because the air was very clean or it could be due to the long inlet path. AMS logging PC crashed around 14:45Z.
11. CPI - heater problems at altitude
12. ADA – not seeing anything but operator unsure of the nature of the problem
13. NOxy – reduced sample flows at altitude but otherwise all fine
14. Nevzorov – Total Water unit alarm lamp flashing on landing approach. Unit switched off

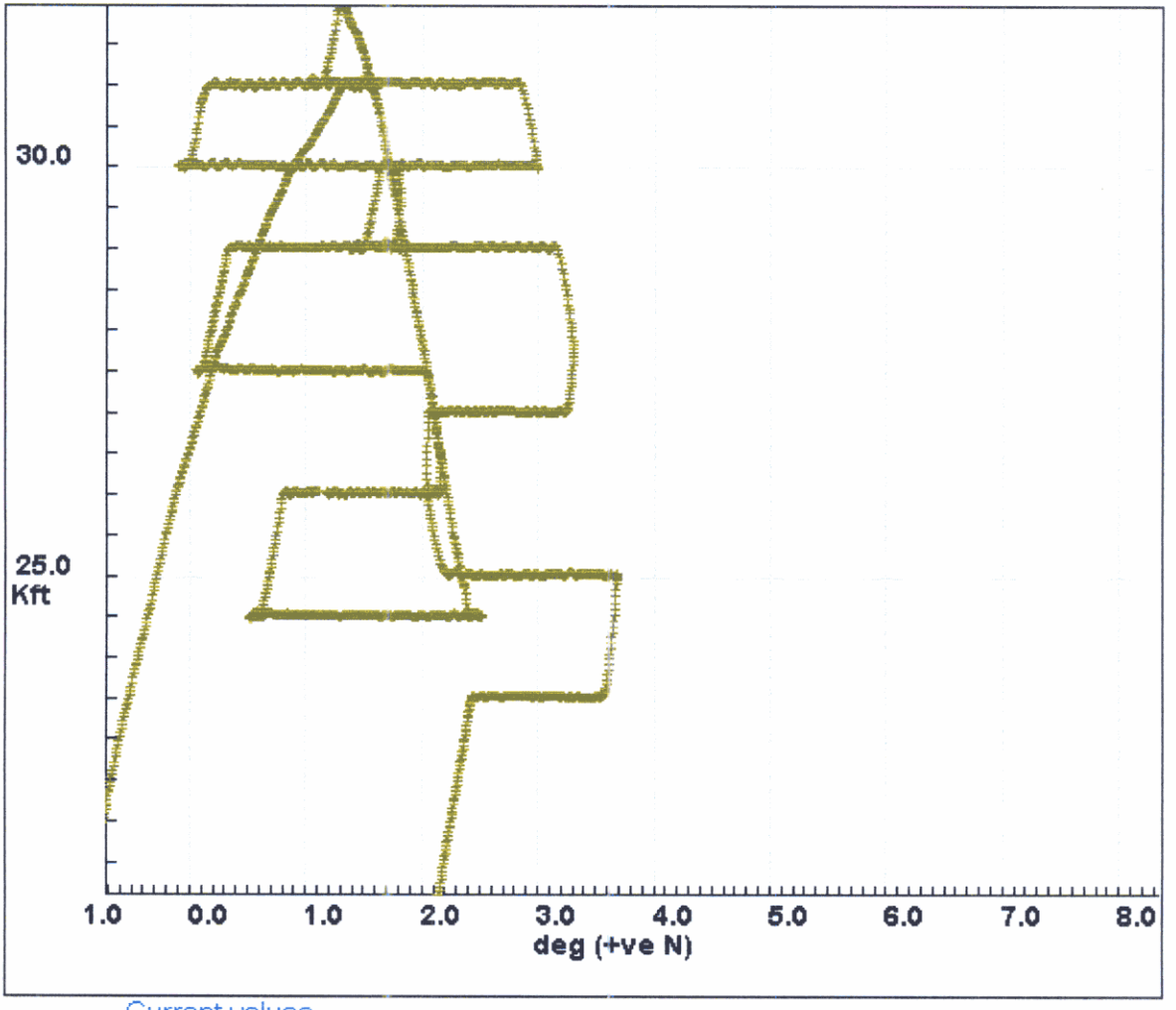
Aircraft

1. Toilet and Galley froze – no tea / coffee / sink

Satcom-H calls made by CCM: 3
Satcom-H calls made by FM: 1

Flight B090 14:47:11

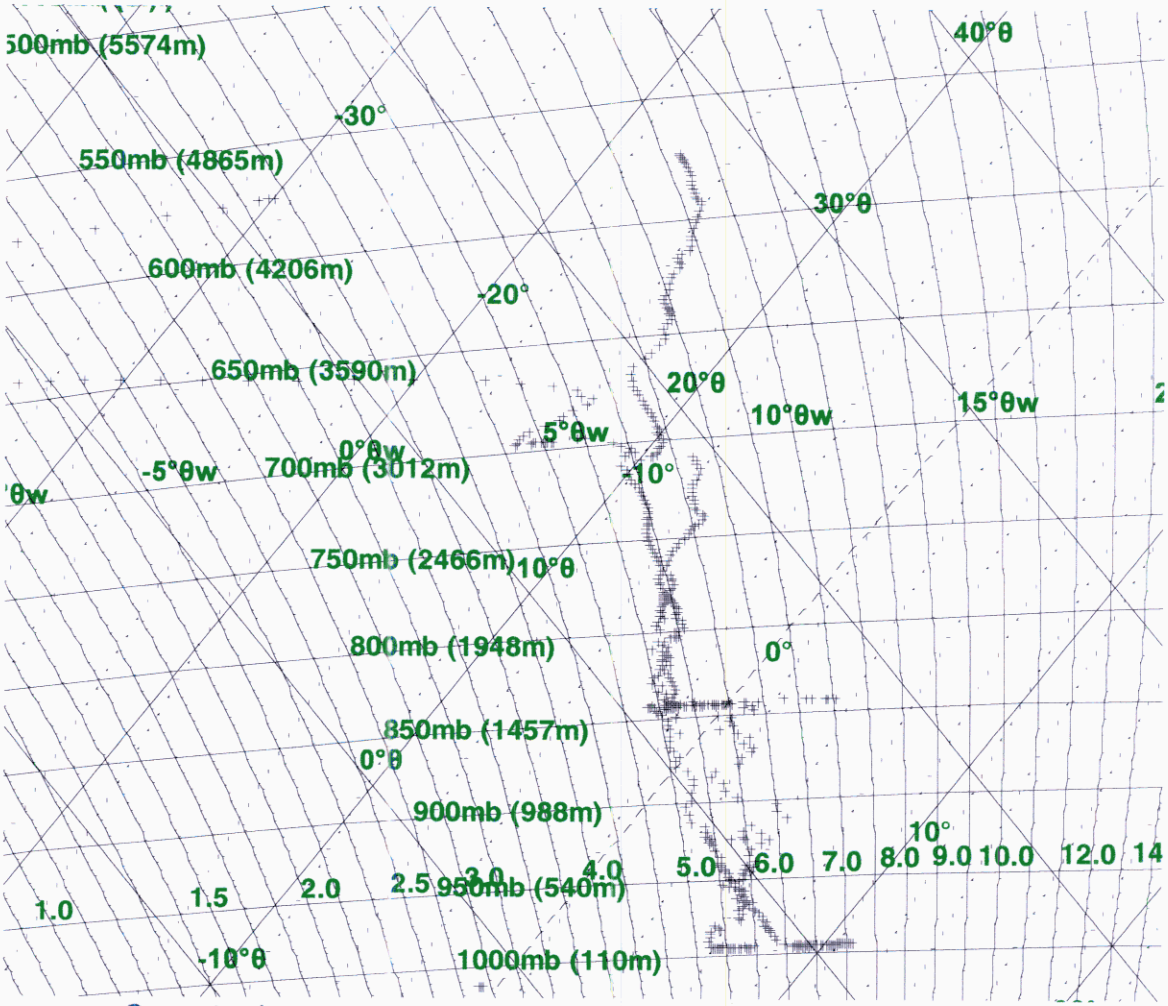
Heading 228 deg Speed 303 knots Height 20.0kft Press 465mb
Lat 55.4N Long 1.5E Wind 21 ms-1/ 234 deg
Temp -29.18C Dewpoint -26.24C
From start to now



Current values			
PRESSURE HEIGHT	20.03	Kft	All
GPS LATITUDE	55.48	deg (+ve N)	
GPS LONGITUDE	1.53	deg (+ve E)	

Flight B090 10:54:20

Heading 344 deg Speed 291 knots Height 14.9kft Press 572mb
Lat 52.8N Long 0.8W Wind 15 ms-1/ 237 deg
Temp -17.18C Dewpoint -30.14C
From 10:36:25 to now



Current values		
STATIC PRESSURE	572.78	mb
DEICED TRUE AIR TEMP	-17.19	deg C
DEW POINT	-30.14	deg C

Flight B090 14:45:39

Heading 228 deg Speed 301 knots Height 20.0kft Press 464mb
Lat 55.5N Long 1.6E Wind 22 ms-1/ 234 deg
Temp -29.06C Dewpoint -26.91C
From 09:49:30 to now

Current values		
INU LONGITUDE	1.68	deg (+ve E)
INU LATITUDE	55.57	deg (+ve N)

MISSING LOG SHEETS:

The following logs are not available for flight B090:

Log	**Reason**
NOxy	No log is ever taken for NOxy
PTrMS	No log is ever taken for PTrMS
ADA/CPI	No log taken or no copy left with FAAM
PAN	No log taken or no copy left with FAAM
Tedlar bags	no samples were analysed for B090